

BIBLIOGRAPHY OF SK KJAERGAARD, 1998-2001

Record - 1

DIALOG(R)File 34:SciSearch(R) Cited Ref Sci

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09418346 Genuine Article#: 402ZW Number of References: 37

Title: Effect of renovating an office building on occupants' comfort and health

Author(s): Pejtersen J (REPRINT) ; Brohus H; Hyldgaard CE; Nielsen JB; Valbjorn O; Hauschildt P; Kjaergaard SK; Wolkoff P

Corporate Source: Natl Inst Occupat Hlth, Dept Indoor Climate, Lerso Parkalle 105/DK-2100 Copenhagen O//Denmark/ (REPRINT); Tech Univ Denmark, Int Ctr Indoor Environm & Energy, DK-2800 Lyngby//Denmark/; Univ Aalborg, Dept Bldg Technol & Struct Engn, Aalborg//Denmark/; Univ Aarhus, Dept Environm & Occupat Med, Aarhus C//Denmark/; Danish Bldg Res Inst, Horsholm//Denmark/; Natl Inst Occupat Hlth, Dept Indoor Climate, DK-2100 Copenhagen//Denmark/

Journal: INDOOR AIR-INTERNATIONAL JOURNAL OF INDOOR AIR QUALITY AND CLIMATE, 2001, V11, N1 (MAR), P10-25

ISSN: 0905-6947 Publication date: 20010300

Publisher: MUNKSGAARD INT PUBL LTD, 35 NORRE SOGADE, PO BOX 2148, DK-1016 COPENHAGEN, DENMARK

Language: English Document Type: ARTICLE

Abstract: An intervention study was performed in a mechanically ventilated office building in which there were severe indoor climate complaints among the occupants. In one part of the building a new heating and ventilation strategy was implemented by renovating the HVAC system, and a carpet was replaced with a low-emitting vinyl floor material; the other part of the building was kept unchanged, serving as a control. A comprehensive indoor climate investigation was performed before and after the intervention. Over a 2-week period, the occupants completed a daily questionnaire regarding their comfort and health. Physiological examinations of eyes, nose and lungs were performed on each occupant. Physical, chemical and sensory measurements were performed before and after the intervention. The renewal of the flooring material was performed after a sensory test of alternative solutions in the laboratory. Before the floor material was installed in the office building, a full-scale exposure experiment was performed in the laboratory. The new ventilation strategy and renovation of the HVAC system were selected on the basis of laboratory experiments on a full-scale mock-up of a cellular office. The severity of occupants' environmental perceptions and symptoms was significantly reduced by the intervention.

PM3006444960

Record - 2

DIALOG(R)File 34:SciSearch(R) Cited Ref Sci

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09148010 Genuine Article#: 372NF Number of References: 9

Title: The eye irritation and odor potencies of four terpenes which are major constituents of the emissions of VOCs from Nordic soft woods

Author(s): Molhave L (REPRINT) ; Kjaergaard SK; HempelJorgensen A; Juto JE; Andersson K; Stridh G; Falk J

Corporate Source: AARHUS UNIV,DEPT ENVIRONM & OCCUPAT HLTH/DK-8000 AARHUS C//DENMARK/ (REPRINT); HUDDINGE UNIV HOSP,INST CLIN SCI, DIV EAR NOSE & THROAT DIS/S-14186 HUDDINGE//SWEDEN/; OREBRO MED CTR HOSP,DEPT OCCUPAT & ENVIRONM MED/S-70185 OREBRO//SWEDEN/

Journal: INDOOR AIR-INTERNATIONAL JOURNAL OF INDOOR AIR QUALITY AND CLIMATE , 2000, V10, N4 (DEC), P315-318

ISSN: 0905-6947 Publication date: 20001200

Publisher: MUNKSGAARD INT PUBL LTD, 35 NORRE SOGADE, PO BOX 2148, DK-1016 COPENHAGEN, DENMARK

Language: English Document Type: ARTICLE

Abstract: Eye goggles were used to estimate human thresholds for sensory eye irritation from four monoterpenes: (+)3-carene, (-)limonene and (+)alpha -pinene and (rac)alpha -terpineol all known as air pollutants emitted from wood. Only a ranking of the irritation thresholds relative to that of n-butanol is given. The measurements showed that the thresholds for eye irritation of the terpenes ranged from subthreshold to below 1,250 mg/m(3). It appears that the irritation of 3-carene and limonene in contrast to the expectations was of the same size as or less than that of n-butanol. Too few subjects reported eye-irritation for ol-pinene and alpha -terpineol to allow estimates of thresholds of these compounds which therefore have much less irritative potency than n-butanol, 3-carene, and limonene. The measurements of one terpene alcohol do not support the hypothesis that monoterpene alcohols, would have lower eye irritation threshold than monoterpene hydrocarbons. The sequence from strongest odorant to weakest was alpha -terpineol, 3-carene, n-butanol, limonene and alpha -pinene. In conclusion, the tested terpenes can probably be ruled out as cause of acute eye irritation indoors. The measured odor thresholds did not deviate from the few values reported in the literature.

PM3006444961

Record - 3

DIALOG(R)File 34:SciSearch(R) Cited Ref Sci

(c) 2001 Inst for Sci Info. All rts. reserv.

09148003 Genuine Article#: 372NF Number of References: 36

Title: Effects on eyes and nose in humans after experimental exposure to airborne office dust

Author(s): Pan ZW; Molhave L (REPRINT) ; Kjaergaard SK

Corporate Source: AARHUS UNIV,DEPT ENVIRONM & OCCUPAT MED, VENNELYST BLVD
6/DK-8000 AARHUS C//DENMARK/ (REPRINT); AARHUS UNIV,DEPT ENVIRONM &
OCCUPAT MED/DK-8000 AARHUS C//DENMARK/

Journal: INDOOR AIR-INTERNATIONAL JOURNAL OF INDOOR AIR QUALITY AND CLIMATE
, 2000, V10, N4 (DEC), P237-245

ISSN: 0905-6947 Publication date: 20001200

Publisher: MUNKSGAARD INT PUBL LTD, 35 NORRE SOGADE, PO BOX 2148, DK-1016
COPENHAGEN, DENMARK

Language: English Document Type: ARTICLE

Abstract: To test sensory irritation symptoms and physiological effects on humans caused by airborne office dust, ten subjects were exposed to both clean air and airborne non-industrial office dust for 3 h in a climate chamber. The average dust concentration in exposure sessions was 394 mug/m(3) total suspended dust (TSD). Tear film break-up time, foam formation in the eye canthus, conjunctival epithelial damage, nasal volume, and nasal minimal cross-sectional area were assessed. Tear film break-up time decreased significantly after dust exposure and nasal volume showed a tendency to decrease. In a questionnaire investigation, significant effects were found from the questions: 'facial skin humidity', 'throat irritation', 'feeling needs of coughing', 'dry nose', 'concentration difficulty', and 'headache'. Additionally, the intensity of the questions 'facial skin humidity', 'dry nose', 'body skin temperature', 'sluggishness', and 'sleepiness' worsened over time. A correlation analysis showed that perceived 'air quality' was significantly correlated with 'dry eyes', 'eye irritation', 'facial skin irritation', 'nose irritation', and 'feeling stressed by chamber occupancy' for subacute responses, and with 'odor intensity' for acute responses. This supports that the perceived air quality may be a function of odor and irritation symptoms. A number of localized symptoms of irritation (e.g. dry nose, throat irritation, coughing) and of general symptoms (e.g. sluggishness, sleepiness, headache, ability to concentration) were mutually correlated acutely and subacutely. These results indicate that non-industrial office dust may cause physiological changes and sensory symptoms in eyes and nose and that these effects have different time courses.

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Record - 4

DIALOG(R)File 34:SciSearch(R) Cited Ref Sci

(c) 2001 Inst for Sci Info. All rts. reserv.

09016881 Genuine Article#: 356YV Number of References: 51

Title: House dust in seven Danish offices

Author(s): Molhave L (REPRINT) ; Schneider T; Kjaergaard SK; Larsen L; Norn S; Jorgensen O

Corporate Source: AARHUS UNIV,DEPT ENVIRONM & OCCUPAT MED, VENNELYST BLVD
6/DK-8000 AARHUS C//DENMARK/ (REPRINT); NIOSH,/DK-2100 COPENHAGEN
O//DENMARK/; ALK LABS,/DK-2000 COPENHAGEN//DENMARK/; UNIV

COPENHAGEN,PANUM INST, DEPT PHARMACOL/DK-2200 COPENHAGEN N//DENMARK/

Journal: ATMOSPHERIC ENVIRONMENT, 2000, V34, N28, P4767-4779

ISSN: 1352-2310 Publication date: 20000000

Publisher: PERGAMON-ELSEVIER SCIENCE LTD, THE BOULEVARD, LANGFORD LANE,
KIDLINGTON, OXFORD OX5 1GB, ENGLAND

Language: English Document Type: ARTICLE

Abstract: Floor dust from Danish offices was collected and analyzed. The dust was to be used in an exposure experiment. The dust was analyzed to show the composition of the dust which can be a source of airborne dust indoors. About 11 kg of dust from vacuum cleaner bags from seven Danish office buildings with about 1047 occupants(12 751 m²) was processed according to a standardized procedure yielding 5.5kg of processed bulk dust. The bulk dust contained 130.000-160.000 CFU g⁻¹ microorganisms and 71.000-90.000 CFU g⁻¹ microfungi. The content of culturable microfungi was 65-123 CFU 30 g⁻¹ dust. The content of endotoxins ranged from 5.06-7.24 EU g⁻¹ (1.45 ng g⁻¹ to 1.01 ng g⁻¹). Allergens (ng g⁻¹) were from 147-159 (Mite), 395-746 (dog) and 103-330 (cat). The macro molecular organic compounds (the MOD-content) varied from 7.8-9.8 mg g⁻¹. The threshold of release of histamine from basophil leukocytes provoked by the bulk dust was between 0.3 and 1.0 mg ml⁻¹. The water content was 2% (WGT) and the organic fraction 33%, 6.5-5.9% (dry) was water soluble. The fiber content was less than 0.2-1.5% (WGT) and the desorbable VOCs was 176-319 µg g⁻¹. Most of the VOC were aldehydes. However, softeners for plastic (DBP and DEHP) were present. The chemical composition includes human and animal skin fragments, paper fibers, glass wool, wood and textilefibers and inorganic and metal particles. The sizes ranged from 0.001-1 mm and the average specific density was 1.0 g m⁻³. The bulk dust was resuspended and injected into an exposure chamber. The airborne dust was sampled and analyzed to illustrate the exposures that can result from sedimented dirt and dust. The airborne dust resulting from the bulk dust reached concentrations ranging from 0.26-0.75 mg m⁻³ in average contained 300-170 CFU m⁻³. The organic fraction was from 55-70% and the water content about 2.5% (WGT). The content of the dust was compared to the similar results reported in the literature and its toxic potency is estimated to be relatively low. The storage of the bulk dust during the experiment had little effect on the specific biological and chemical composition. (C) 2000 Elsevier Science Ltd. All rights reserved.

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DIALOG(R)File 34:SciSearch(R) Cited Ref Sci

(c) 2001 Inst for Sci Info. All rts. reserv.

09016880 Genuine Article#: 356YV Number of References: 28

Title: Sensory and other neurogenic effects of exposures to airborne office dust

Author(s): Molhave L (REPRINT) ; Kjaergaard SK; Attermann J

Corporate Source: AARHUS UNIV,DEPT ENVIRONM & OCCUPAT MED, VENNELYST BLVD
6, BLD 260/DK-8000 AARHUS C//DENMARK/ (REPRINT)

Journal: ATMOSPHERIC ENVIRONMENT, 2000, V34, N28, P4755-4766

ISSN: 1352-2310 Publication date: 20000000

Publisher: PERGAMON-ELSEVIER SCIENCE LTD, THE BOULEVARD, LANGFORD LANE,
KIDLINGTON, OXFORD OX5 1GB, ENGLAND

Language: English Document Type: ARTICLE

Abstract: This Danish Office Dust Experiment investigated the response of 24 healthy non-sensitive adult subjects to exposure to normal office dust in the air (7 $\mu\text{g m}^{-3}$ clean air, 136 and 390 $\mu\text{g m}^{-3}$ TSP). The dust had no major identifiable specific reactive components. The exposure duration was 51/4h and was arranged in a climate chamber in controlled atmospheric conditions. Measurements were made acutely at exposure onset, subacutely at exposure end and next day (late). As secondary aims the time course and threshold of any observed effect of the exposures, and the characteristics of any hyperresponding subgroup were investigated. In a questionnaire with 36 questions the dust exposures caused increased acute, subacute and late perceptions of reduced air quality, acute and subacute increased odor intensity, acute eye irritation, acute and late heavy head, subacute feeling of perspiration, and subacute general irritation. Cough increased subacutely during exposures. In addition, a performance test showed effects of dust exposures which also affected 'Mood Scale' ratings. No effect was seen on an addition test for distraction, and objective measurements of skin humidity. The overall conclusion of the study is that healthy subjects without hypersensitivity reactions seem to respond to airborne house dust. The responses are both subjective sensory reactions and other neurogenic effects even at exposure levels within the range found in normal buildings. Some of the effects appeared acutely and decreased through adaptation while others increased during prolonged exposure and remained for more than 17 h after the exposure ended. The findings may indicate for this type of dust a threshold level for the dose-response relationships below 140 $\mu\text{g m}^{-3}$. (C) 2000 Elsevier Science Ltd. All rights reserved.

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Record - 6

DIALOG(R)File 34:SciSearch(R) Cited Ref Sci

(c) 2001 Inst for Sci Info. All rts. reserv.

08846453 Genuine Article#: 335UE Number of References: 28

Title: Cytokine release from the nasal mucosa and whole blood after experimental exposures to organic dusts

Author(s): Sigsgaard T (REPRINT) ; BonefeldJorgensen EC; Kjaergaard SK; Mamas S; Pedersen OF

Corporate Source: AARHUS UNIV, INST ENVIRONM & OCCUPAT MED, UNIV PK, BLDG 180/DK-8000 AARHUS//DENMARK/ (REPRINT); INSERM,U485, UNITE ASSOCIEE INST PASTEUR, UNITE PHARMACOL CELLULAIRE/PARIS//FRANCE/

Journal: EUROPEAN RESPIRATORY JOURNAL, 2000, V16, N1 (JUL), P140-145

ISSN: 0903-1936 **Publication date:** 20000700

Publisher: MUNKSGAARD INT PUBL LTD, 35 NORRE SOGADE, PO BOX 2148, DK-1016 COPENHAGEN, DENMARK

Language: English **Document Type:** ARTICLE

Abstract: The aim of this study was to assess the cytokine response after nasal exposure to organic dusts.

In a double blinded, crossover study five garbage workers, with occupational airway symptoms and five healthy garbage workers were intranasally exposed to endotoxin (lipopolysaccharide LPS), beta-1,3-D-glucan (GLU), *Aspergillus* sp., compost or the saline dilute for 15 min. Nasal cavity volume and nasal lavage (NAL) were performed at baseline and 3, 6, 11 h postexposure. NAL was analysed, with differential cell counts, cysteinyl-leukotrienes, tumour necrosis factor alpha, interleukin (IL)-1 beta, IL-6 and IL-8. A whole blood assay on cytokine-release was performed, with LPS and GLU,

NAL cytokines neutrophils, lymphocytes and albumin increased significantly at 6 h after LPS exposure. GLU induced an increase in albumin and a slight increase in IL-1 beta 6-11 h post exposure. In the WBA a significant increase in all cytokines after exposure to LPS as well as GLU was found. Significantly more cells were seen in NAL of the control group 6 h post LPS exposure.

In conclusion lipopolysaccharide is the most potent inducer of inflammation in the nasal mucosa whereas compost and beta-1,3-D-glucan only induce minor changes. This reaction to lipopolysaccharide is attenuated in workers with occupational airway symptoms. In whole blood assay, however, beta-1,3-D-glucan also induces cytokine release, indicating a different protective effect of the nasal mucosa towards lipo-polysaccharide and beta-1,3-D-glucan.

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DIALOG(R)File 34:SciSearch(R) Cited Ref Sci

(c) 2001 Inst for Sci Info. All rts. reserv.

08326781 Genuine Article#: 272HC Number of References: 14

Title: Sensory eye irritation in humans exposed to mixtures of volatile organic compounds

Author(s): HempelJorgensen A (REPRINT) ; Kjaergaard SK; Molhave L; Hudnell KH

Corporate Source: AARHUS UNIV,DEPT ENVIRONM & OCCUPAT MED, OLE WORMS ALLE, BLDG 180/DK-8000 AARHUS C//DENMARK/ (REPRINT); US EPA,DIV NEUROTOXICOL/RES TRIANGLE PK//NC/27711

Journal: ARCHIVES OF ENVIRONMENTAL HEALTH, 1999, V54, N6 (NOV-DEC), P416-424

ISSN: 0003-9896 Publication date: 19991100

Publisher: HELDREF PUBLICATIONS, 1319 EIGHTEENTH ST NW, WASHINGTON, DC 20036-1802

Language: English Document Type: ARTICLE

Abstract: Eight subjects participated in a controlled eyes-only exposure study of human sensory irritation in ocular mucosal tissue. The authors investigated dose-response properties and the additive effects of three mixtures of volatile organic compounds. The dose-response relationships for these mixtures showed increases in response intensity as concentration increased. Replication of exposure did not result in significantly different dose-response relationships. Moreover, the result implied that components of the three mixtures interacted additively to produce ocular irritation, a result referred to as simple agonism. Finally, the authors addressed the comparability of two methods to measure sensory irritation intensity (visual analogue scale and a comparative scale). The results indicated that the two rating methods produced highly comparable results.

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DIALOG(R)File 34:SciSearch(R) Cited Ref Sci

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08185593 Genuine Article#: 255MJ Number of References: 29

Title: Reactions of healthy persons and persons suffering from allergic rhinitis when exposed to office dust

Author(s): Hauschildt P; Molhave L (REPRINT) ; Kjaergaard SK

Corporate Source: UNIV AARHUS,DEPT ENVIRONM & OCCUPAT MED, VENNELYST BLVD
6/DK-8000 AARHUS C//DENMARK/ (REPRINT); UNIV AARHUS,DEPT ENVIRONM &
OCCUPAT MED/DK-8000 AARHUS C//DENMARK/

Journal: SCANDINAVIAN JOURNAL OF WORK ENVIRONMENT & HEALTH, 1999, V25, N5 (OCT), P442-449

ISSN: 0355-3140 Publication date: 19991000

Publisher: SCAND J WORK ENV HEALTH, TOPELIUKSENKATU 41A, SF-00250 HELSINKI, FINLAND

Language: English Document Type: ARTICLE

Abstract: Objectives Reactions to airborne office dust among healthy subjects and subjects suffering from allergic rhinitis were investigated.

Methods Twelve healthy and 11 subjects suffering from allergic rhinitis were exposed to clean air [17 JSD 2) $\mu\text{g}/\text{m}^3$] and office dust [439 (SD 68) $\mu\text{g}/\text{m}^3$] for 245 minutes. The effect measurements included subjective sensations (questionnaire and potentiometer ratings), mood scale, peak flow, bronchial provocation with histamine using forced expiratory volume in 1 second as the effect measure, nasal mucosal swelling, tear film stability, epithelial damage, foam formation in the eye canthus, threshold for eye irritation with carbon dioxide, eye redness, cellular content of conjunctival fluid, and an addition test for distraction. As many investigations were made and as many statistical analyses (including subgroup analyses) were carded out, the risk of mass significance appeared. This problem was dealt with using the Bonferroni correction for multiple significance tests.

Results The mean ratings of the potentiometer were higher (the subjects showed more irritation) during the dust exposure. The objective investigations showed only indications of effects of dust exposure, and some of the indications were in biologically unexplainable directions. No difference in the reactions to dust was observed between the healthy subjects and the subjects suffering from allergic rhinitis.

Conclusions Dust does not seem to have objective or subjective effects on humans, as only indications of dust effects were found. Subjects suffering from allergic rhinitis do not appear to be a risk group in relation to dust exposure.

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DIALOG(R)File 34:SciSearch(R) Cited Ref Sci

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07512864 Genuine Article#: 175UW Number of References: 21

Title: Time course of sensory eye irritation in humans exposed to n-butanol and 1-octene

Author(s): HempelJorgensen A (REPRINT) ; Kjaergaard SK; Molhave L; Hudnell HK

Corporate Source: AARHUS UNIV,DEPT ENVIRONM & OCCUPAT MED, OLE WORMS ALLE, BLDG 180, UNIV PARKEN/DK-8000 AARHUS C//DENMARK/ (REPRINT); US EPA,DIV NEUROTOXICOL/RES TRIANGLE PK//NC/27711

Journal: ARCHIVES OF ENVIRONMENTAL HEALTH, 1999, V54, N2 (MAR-APR), P86-94
ISSN: 0003-9896 Publication date: 19990300

Publisher: HELDREF PUBLICATIONS, 1319 EIGHTEENTH ST NW, WASHINGTON, DC 20036-1802

Language: English Document Type: ARTICLE

Abstract: In this study, we investigated the time course effect of sensory eye irritation in 16 subjects exposed (i.e., eye only) to n-butanol and 1-octene. Half the subjects were exposed to n-butanol, and the remaining subjects were exposed to 1-octene. Each subject was studied on 5 different days; during each day each subject was exposed in three runs (i.e., run 1, run 2, and run 3) to a constant concentration of either n-butanol or 1-octene. We performed run 1 and run 3, both of which lasted 15 min each, to evaluate persistence in 'sensitization.' We performed run 2, which lasted 60 min, to study the time course of sensory irritation. Ratings of ocular irritation intensity were obtained continuously during all three runs. The exposure concentrations for n-butanol were 0 mg/m(3), 300 mg/m(3), 900 mg/m(3), and 3 000 mg/m(3), and the exposure concentrations for 1-octene were 0 mg/m(3), 6 000 mg/m(3), 10 400 mg/m(3), and 18 000 mg/m(3). During run 2, we observed a slight increase in perceived eye irritation intensity for the lower concentrations of 1-octene and for all exposure concentrations of n-butanol. However, the threshold for irritation was clearly exceeded for only the 1-octene 10 400-mg/m(3) and 18 000-mg/m(3) exposures. During these two exposures, the response increased 10-fold following 20-40 min of exposure during run 2, after which the response remained constant. We investigated the existence of persistence in 'sensitization' by comparing intensity of responses between run 1 and run 3. Persistence in 'sensitization' was apparent for only the 1-octene exposure.

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DIALOG(R)File 34:SciSearch(R) Cited Ref Sci

(c) 2001 Inst for Sci Info. All rts. reserv.

06781540 Genuine Article#: ZR287 Number of References: 28

Title: Cytological changes and conjunctival hyperemia in relation to sensory eye irritation

Author(s): HempelJorgensen A (REPRINT) ; Kjaergaard SK; Molhave L

Corporate Source: UNIV AARHUS,DEPT ENVIRONM & OCCUPAT MED, OLE WORMS ALLE, BLDG 180/DK-8000 AARHUS C//DENMARK/ (REPRINT)

Journal: INTERNATIONAL ARCHIVES OF OCCUPATIONAL AND ENVIRONMENTAL HEALTH, 1998, V71, N4 (JUN), P225-235

ISSN: 0340-0131 Publication date: 19980600

Publisher: SPRINGER VERLAG, 175 FIFTH AVE, NEW YORK, NY 10010

Language: English Document Type: ARTICLE

Abstract: In general, irritation is a physiological response to a chemical or physical stimulus involving objective changes (e.g., local redness and edema) and subjective sensations (e.g., pruritus and pain). The perception of an irritating stimulus in the eyes and the upper airways is called sensory irritation. Sensory irritation is a prevalent symptom in relation to complaints about indoor air quality. The intensity of perceived sensory irritation in humans has mainly been evaluated using psychophysical methods. However, perceived sensory irritation is dependent on the subject expressing the symptoms; that is, it is a subjective measure. This is a problem in assessment of irritation effects from air pollution or other factors, since the expression of the irritation symptoms may be biased by, for example, interaction with other people and odors. The subjectivity of the measures is an important complication in several studies dealing with problems regarding indoor air quality. The bias problems make it important to complement the psychophysical measurements of sensory irritation with objective assessments of irritation. In addition, only little is known about the association between sensory irritation and possible physiological/pathological changes in the mucosal membranes in relation to studies of indoor air. Two studies (study 1 and study 2) were conducted to investigate changes in conjunctival hyperemia and conjunctival fluid cytology for subjects exposed to volatile organic compounds (VOCs) in their eyes only. Eight subjects participated in study 1. Each subject was exposed to three different mixtures of VOCs. A total of 16 subjects participated in study 2. Half of the subjects were exposed to 1-octene and the other half, to n-butanol. In both studies, photographs of bulbar conjunctiva were taken and conjunctival fluid was sampled before and after exposure. Moreover, the perceived irritation intensities were registered continuously during exposure. Overall, perceived irritation intensity and conjunctival hyperemia increased with increasing exposure concentrations, whereas cytological changes in the conjunctival fluid samples did not seem to be related to exposure concentration, perceived irritation, or changes in conjunctival hyperemia.

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